

THAT WHICH IS CLAIMED IS:

1. An apparatus for perforating an advancing plastic film, comprising:

a frame;

5 a main shaft mounted in the frame so as to be rotatable about a central axis of the main shaft;

at least one needle roller coupled to the main shaft in radially offset position therefrom such that rotation of the main shaft through a part of a revolution moves the at least one needle roller through a predetermined arc of motion, the at least one needle roller being arranged to be freely rotatable about an axis of the at least one needle roller,
10 independently of the rotation of the main shaft; and

an actuator coupled with the main shaft and operable to rotate the main shaft so as to move the at least one needle roller through said arc of motion such that at one end of said arc of motion, the at least one needle roller is in an operative position, adjacent the advancing film, engaging and perforating the film, and at an opposite end of
15 said arc of motion, the at least one needle roller is in an inoperative position, spaced apart from the advancing film.

2. The apparatus of Claim 1, wherein the frame comprises a pair of frame plates spaced apart, opposite one another.

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3. The apparatus of Claim 2, wherein the frame further comprises a support bar connecting the frame plates.

4. The apparatus of Claim 2, wherein the main shaft extends between the frame
25 plates.

5. The apparatus of Claim 1, wherein the at least one needle roller is coupled to the main shaft by being mounted on a secondary shaft fixedly mounted to the main shaft with a pair of arms, wherein the arms extend radially out from the axis of the main shaft.

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6. The apparatus of Claim 1, wherein the at least one needle roller is comprised of a cylindrical body with a center bore and pins extending out radially from the body.

7. The apparatus of Claim 6, wherein the pins are tapered outward from the body.

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8. The apparatus of Claim 1, further comprising a needle roller cover.

9. The apparatus of Claim 8, wherein the cover limits outside contact with the at least one needle roller at all points through said predetermined arc of motion.

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10. The apparatus of Claim 1, further comprising at least one backup roller mounted in the frame so as to be freely rotatable about an axis of the at least one backup roller.

11. The apparatus of Claim 10, wherein the at least one backup roller is radially offset from the main shaft, positioned such that when the at least one needle roller is in the inoperative position, the at least one needle roller is spaced apart from the at least one backup roller, and when the at least one needle roller is in the operative position, the at least one needle roller is adjacent the at least one backup roller forming a nip therewith, through which nip the advancing film passes, the at least one needle roller in the operative position engaging the advancing film against the at least one backup roller and perforating the advancing film.

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12. The apparatus of Claim 10, wherein the at least one backup roller further comprises grooves.

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13. The apparatus of Claim 1, wherein the actuator is a rotary device.

14. The apparatus of Claim 13, wherein the rotary device is a solenoid.

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15. The apparatus of Claim 1, wherein the apparatus is structured and arranged for attachment to a foam-in-bag cushion production apparatus.

16. The apparatus of Claim 1, wherein the apparatus comprises two needle rollers.

17. The apparatus of Claim 10, wherein the apparatus comprises two backup rollers.

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18. An apparatus for creating perforations over a defined area through a moving foam-in-bag film at any point along the length of the film, wherein the apparatus comprises:

a pair of frame plates spaced apart opposite one another;

10 a main shaft extending between the frame plates and mounted so as to be rotatable about a central axis of the main shaft;

secondary shafts having central axes and being fixedly mounted to the main shaft in radially offset positions therefrom;

15 needle rollers mounted on each of the secondary shafts so as to be freely rotatable about the secondary shafts,

said needle rollers each comprising a cylindrical body with a center bore and pins extending out radially from the body;

tertiary shafts cantilevered off each frame plate and having free ends;

20 backup rollers mounted on each of said tertiary shafts such that the backup rollers are freely rotatable about the tertiary shafts; and

means for rotating the main shaft so as to move the needle rollers between operative and inoperative positions in which the needle rollers are respectively in contact and out of contact with the backup rollers, whereby a film passing between the backup rollers and the needle rollers is perforated by the needle rollers when the needle rollers
25 are in the operative position and is not perforated when the needle rollers are in the inoperative position.

19. The apparatus of Claim 18, further comprising a support bar connecting the frame plates.

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20. The apparatus of Claim 18, wherein each of the secondary shafts is mounted to the main shaft with a pair of arms, wherein the arms extend radially out from the axis of the main shaft.

5 21. The apparatus of Claim 20, wherein the secondary shafts are mounted to the main shaft such that the axes of the secondary shafts are always in line with one another.

22. The apparatus of Claim 20, wherein the axes of the secondary shafts are parallel to the axis of the main shaft.

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23. The apparatus of Claim 18, wherein the pins are tapered outward from the body.

24. The apparatus of Claim 18, wherein the backup rollers comprise grooves in substantial alignment with the pins of the needle rollers

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25. The apparatus of Claim 18, further comprising a support bar connecting the free ends of the tertiary shafts.

26. The apparatus of Claim 18, further comprising needle roller covers.

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27. The apparatus of Claim 26, wherein the covers limit outside contact with the needle rollers while said rollers are in or out of contact with the backup rollers and at any point in between.

25 28. The apparatus of Claim 18, wherein the means for rotating the main shaft comprise a rotary device.

29. The apparatus of Claim 28, wherein the rotary device is a solenoid.

30 30. The apparatus of Claim 18, wherein the apparatus is structured and arranged for attachment to a foam-in-bag cushion production apparatus.

31. A method for preparing foam-in-bag cushions comprising:

supplying at least one web of film and manipulating said at least one web of film to position two film portions in overlying opposition to each other, and sealing said two film portions along seal lines to form a bag open along one side and defining an interior space therein;

injecting a foam-forming composition into the interior space of the bag, and sealing said film portions along said one side of the bag to enclose the foam-forming composition in the bag; and

perforating the bag to form vents, wherein said perforating step comprises the steps of:

advancing the at least one web of film between at least one freely rotatable backup roller and at least one freely rotatable needle roller supporting a plurality of pins for perforating the film; and

moving the at least one needle roller from an inoperative position, spaced from the at least one backup roller such that the pins are disengaged from the film, into an operative position adjacent the at least one backup roller such that the pins engage the film and perforate the film.

32. The method of Claim 31, further comprising the step of interrupting the perforating of the advancing film by moving the at least one needle roller from the operative position to the inoperative position.

33. The method of Claim 32, wherein the step of interrupting the perforating of the advancing film is conducted in synchronism with the advancement of the film so as to position the vents in the film in a predetermined location with respect to the bag.

34. The method of Claim 32, wherein the interrupting the perforating of the advancing film is fully automated.

35. The method of Claim 31, wherein moving the at least one needle roller from an inoperative position into an operative position comprises rotating a main shaft, wherein the at least one needle roller is coupled to the main shaft in radially offset position therefrom.

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36. The method of Claim 35, wherein the rotating of the main shaft comprises actuation with a rotary device.

37. The method of Claim 36, wherein the rotary device is a solenoid.

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38. The method of Claim 31, wherein the at least one needle roller is rotated about an axis thereof by the advancement of the film in engagement with the at least one needle roller.

15 39. The method of Claim 31, wherein the film is continuously in contact with the backup roller such that advancement of the film causes the backup roller to rotate about an axis thereof.

20 40. The method of Claim 31, wherein the pins of the at least one needle roller perforate both of the two film portions of the bag.

41. The method of Claim 31, wherein the vents are configured to allow gases to flow into and out of the bag while substantially preventing the foam from escaping.

25 42. A method for perforating a foam-in-bag cushion comprising:
supplying at least one web of film and manipulating said at least one web of film to position two film portions in overlying opposition to each other, and sealing said two film portions along seal lines to form a bag open along one side and defining an interior space therein;

injecting a foam-forming composition into the interior space of the bag, and sealing said film portions along said one side of the bag to enclose the foam-forming composition in the bag; and

5 perforating the bag to form vents, wherein said perforating step comprises the steps of:

advancing the at least one web of film between at least one freely rotatable backup roller and at least one freely rotatable needle roller supporting a plurality of pins for perforating the film; and

10 moving the at least one needle roller from an inoperative position, spaced from the at least one backup roller such that the pins are disengaged from the film, into an operative position adjacent the at least one backup roller such that the pins engage the film and perforate the film.

43. The method of Claim 42, further comprising the step of interrupting the
15 perforating of the advancing film by moving the at least one needle roller from the operative position to the inoperative position.

44. The method of Claim 43, wherein the step of interrupting the perforating of the
20 advancing film is conducted in synchronism with the advancement of the film so as to position the vents in the film in a predetermined location with respect to the bag.

45. The method of Claim 44, wherein the interrupting of the perforating of the advancing film is fully automated.

25 46. The method of Claim 42, wherein moving the at least one needle roller from an inoperative position into an operative position comprises rotating a main shaft, wherein the at least one needle roller is coupled to the main shaft in radially offset position therefrom.

30 47. The method of Claim 46, wherein the rotating of the main shaft comprises actuation with a rotary device.

48. The method of Claim 47, wherein the rotary device is a solenoid.

49. The method of Claim 42, wherein the at least one needle roller is rotated about an
5 axis thereof by the advancement of the film in engagement with the at least one needle
roller.

50. The method of Claim 42, wherein the film is continuously in contact with the
backup roller such that advancement of the film causes the backup roller to rotate about
10 an axis thereof.

51. The method of Claim 42, wherein the pins of the at least one needle roller
perforate both of the two film portions of the bag.

15 52. The method of Claim 42, wherein the vents are configured to allow gases to flow
into and out of the bag while substantially preventing the foam from escaping.

53. A method for perforating a plastic film comprising:
supplying at least one web of film and manipulating said at least one web of film
20 to position two film portions in overlying opposition to each other;
advancing the at least one web of film along a path intersecting a predetermined
arc of motion of at least one freely rotatable needle roller supporting a plurality of pins
for perforating the film; and
moving the at least one needle roller from an inoperative position at one end of
25 the predetermined arc of motion, spaced from the at least one web of film such that the
pins are disengaged from the film, into an operative position at the opposite end of the
predetermined arc of motion, adjacent to the at least one web of film such that the pins
engage the film and perforate the film.

54. The method of Claim 53, wherein said pins engage said film such that the pins at least partially perforate the overlying film portion being in closer proximity to said at least one needle roller without perforating an underlying film portion.

5 55. The method of Claim 53, wherein said pins engage said film such that the pins perforate the overlying film portion being in closer proximity to said at least one needle roller and at least partially perforate an underlying film portion.

56. The method of Claim 53, further comprising interrupting the perforating of the
10 advancing film by moving the at least one needle roller from the operative position to the inoperative position.

57. The method of Claim 53, wherein moving the at least one needle roller from an inoperative position into an operative position comprises rotating a main shaft, wherein
15 the at least one needle roller is coupled to the main shaft in radially offset position therefrom.

58. The method of Claim 57, wherein the rotating of the main shaft comprises actuation with a rotary device.

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59. The method of Claim 58, wherein said rotary device is a solenoid.

60. A method for perforating a plastic film comprising:
supplying at least one web of film and manipulating said at least one web of film
25 to position two film portions in overlying opposition to each other;
advancing the at least one web of film along a path intersecting a predetermined arc of motion of two freely rotatable needle rollers supporting a plurality of pins for perforating the film, wherein at least a portion of the at least one web of film advances between one freely rotatable needle roller and one freely rotatable backup roller; and
30 moving the needle rollers from an inoperative position at one end of the predetermined arc of motion, spaced from the at least one web of film and the backup

- roller such that the pins are disengaged from the film, into an operative position at the opposite end of the predetermined arc of motion, adjacent to the at least one web of film such that the pins engage the film, perforating both film portions where the at least one web of film advances between the backup roller and the needle rollers and perforating
- 5 only one film portion where the at least one web of film intersects the predetermined arc of motion of the needle rollers in the absence of a backup roller.